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SUBJECT Hydroelectric Plant at Lanabregasi and the Tirana Aqueduct

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1. Work was begun in 1949 on the construction of the hydroelectric plant at Lanabregasi and of the conduits which, capturing the water from the Selite springs, will supply the power for the central plant, as well as the water for the Tirana aqueduct.

2. The original project was modified, mainly by Soviet engineers, as the Tirana Government wished to build the whole unit in such a way as to make it almost invulnerable in the event of war. In fact, the siphon installations, the conduits, and the hydroelectric plant itself, were to be within tunnels and protected by a natural covering of earth.

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3. It was estimated that the whole project would cost 650 million leks, to be defrayed over a period of four fiscal years. For the year 1949 the Albanian Government had set aside 230 million leks; of this, however, only a third was spent, due to the lack of materials and the means of getting them. By 1 September 1949, only 80,000,000 leks were spent.*

4. The general characteristics of the plant are as follows:

   a. Length, from the springs to the machine house, about 12,000 meters (11,883).

   b. Constant gradient of the conduits in the tunnel: 0.5 meters per 1,000.

   c. Discharge from the spring: (1) minimum output, 45 liters per minute; (2) maximum output, 1,200 liters per minute.

   d. Maximum discharge from the conduits: 1,000 liters per minute.

   e. The installations are calculated to handle 2,000 liters per minute.

   f. Cross-section of tunnel: ovoid, with two different dimensions.

   g. Special steel pipe units for the siphon.

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h. Location of the works is underground, except for two visible connecting canals on the surface, the combined lengths of which are 50 or 51 meters.

5. The interior, for ease of description, can be divided into the following parts:

a. The distance from the Selite springs to the outskirts of Qafemolle, a length of 4,560 meters. There is a conduit in a tunnel which crosses through Mt. Jekenit (1,337 meters). This tunnel, the first of the entire project to be constructed, was named the "Koleka" tunnel, after Minister Spiro Koleka, whose idea it had been in the first place. Under Mt. Jekenit there are also the "Jekenit I, II and III" tunnels. Between the "Koleka" and the "Jekenit I" tunnels there is a connecting canal 35 or 36 meters in length. There is another between "Jekenit II" and "Jekenit III", 15 meters in length. These canals, with an overall length of 50 or 51 meters, are to be the only exposed and visible portions of the installation when it is completed.

b. There is a 3,500-meter siphon conduit with steel pipes to cover the area between the "Jekenit III" and the "Large Dajti" tunnels.

c. There is a 2,323-meter tunnel conduit under Mt. Dajti (1,611 meters), consisting of two straight channels forming an angle; one portion (the upper level, 1,890 meters in length), is called the "Large Dajti" tunnel; the second portion (on a lower level, 433 meters in length), is called the "Small Dajti" tunnel.

d. There is a 1,500-meter steel-pipe pressure conduit connecting the "Small Dajti" tunnel with the machine house, with a difference in level of 573 meters.

e. The machine house is 52.16 meters long, 8 meters wide, and 9 meters high; it is connected with a so-called service and security tunnel. A canal to carry off water has been placed under the machine house.

6. Along the stretch which leads from the springs to the siphon intake (that is, from the beginning of the "Koleka" tunnel to the end of the "Jekenit III" tunnel), for a distance of 4,560 meters the tunnel is ovoid in cross-section, with the following dimensions: internal height 1.80 meters, internal width 1.40 meters; thickness of concrete, from 20 to 30 centimeters (average 25 centimeters). This stretch has several bends in it, the main one being the point at which the "Koleka" tunnel joins the "Jekenit I" tunnel at an angle of 146°; between "Jekenit II" and "Jekenit III" there is an angle of 152°. Each angle is formed by a round arch (arc) with a radius of 10 to 12 meters. All along this stretch there are at least 6 meters of clay soil covering the vault (this least coverage occurs over the "Jekenit I" tunnel).

7. The length of the major axes of the various tunnels is as follows:

"Koleka "	1,693 meters
Connecting Canal I	35 or 36 meters
"Jekenit I"	726 meters
"Jekenit II"	1,035 meters
Connecting Canal II	15 meters
"Jekenit III"	1,056 meters

8. The water intake at Selite is at an elevation of 936 meters; at the end of the "Jekenit III" tunnel (and the beginning of the siphon) the elevation is 933.70 meters.

9. The greatest height of the connecting canal (aqueduct) between the "Koleka" and "Jekenit I" tunnels is 4 meters; it is made of reinforced concrete, with four supports (two main supports and two abutments). There is also a walk for the guards.

10. The connecting canal between the "Jekenit II" and "Jekenit III" tunnels is 15 meters in length, with a maximum height of 4 meters; it is made of reinforced concrete, with two abutments. Details are the same as for the first connecting canal.

11. The siphon conduit, joining the "Jekenit III" with the "Large Dajti" tunnel, is at an elevation of 933.70 meters; height at the lower end of the siphon (and the beginning of the "Large Dajti" tunnel) is 904.75 meters; that is, a loss of height of 28.95 meters. Distance (as the crow flies) between the beginning of the siphon and the end: 2,800 meters; the linear length of the siphon: 3,500 meters. The horizontal projection of the course of the siphon is not a straight line. The lowest point of the siphon is 633.70 meters, with an intervening loss of height of 300 meters.

12. The conduit, made with a special steel pipe unit, will consist of a single pipe with a diameter of 60 centimeters, or of two pipes, parallel and 50 meters apart, 45 centimeters in diameter. The pipes of either dimension would have a thickness of 20 mm. Along its entire course it will be fitted with piezometric columns, in addition to the regular safety and cleaning installations. Deviators will be located at each change of direction. 50X1-HUM

13. With regard to the conduits in the "Large Dajti" and the "Small Dajti" tunnels, the cross-section of the tunnel is ovoid, with the following dimensions: internal width, 2.45 meters; internal height, 2.50 meters; thickness of the concrete, 25 centimeters. Combined length of the two tunnels: 2,323 meters ("Large Dajti," 1,890 meters, "Small Dajti", 433 meters). The two tunnels are joined at an angle of 146°, formed by a round arch (arc) with a radius of 12 meters. The cross-section of the two tunnels is larger than the others because they will function as a safety reservoir; in fact, these tunnels should always be quite full, to avoid the formation of air pockets. The tunnels of Mt. Dajti will be able to hold about 10,000 cubic meters of water; it is to be noted that the reservoir, formed by two such tunnels, should not be considered as a reserve, since it could not by itself supply the plant for more than 4 or 5 hours. The two Dajti tunnels are made of non-reinforced concrete.

14. There is a pressure pipe from the end of the "Small Dajti" to the machine house. As the crow flies, the distance is about 800 meters; the pipe itself is 1,500 meters in length. The height at the point of the Dajti pipes' intake is about 903 meters; that of the machine shop intake is 330 meters, with a difference in level of about 573 meters. The pipes do not run in a straight line, but follow the contours of the terrain.

15. The water will have a pressure of 60 atmospheres at the machine house; this pressure will be maintained at 30 atmospheres by pressure reducers of a type not yet known, as they had not (at time of this report) yet been installed. The pipe units will probably also have a siphon. The rate of fall will be regulated by the turbines. Pipe units 60 centimeters in diameter or two pipe units 45 centimeters in diameter will also be used for this conduit; the thickness of the steel pipes will be 20 or 25 millimeters. The pipe units will consist of 6-meter units, each of which will have a support consisting of a cement block in which the pipe is half sunk and held in the upper part by two supports with a transverse bar. The sections of the pipe unit will be mounted telescope fashion. At regular intervals the conduit will have valves and piezometric columns, and along the course of the tunnels and pipe units there will be four loading and unloading chambers.

16. The chambers are to be located as follows:

a. At the Selite springs intake, with sluice gates and valves to divert the course of the water, so that the flow of water can be stopped along the entire course of the conduit.

b. At the end of "Jekenit III" (and the beginning of the siphon), especially to permit inspection of the siphon.

c. At the end of the siphon (and the beginning of "Large Dajti") for all cleaning operations necessary for the "Large" and "Small Dajti" tunnels, and for the control of the reservoir tunnels, in which the volume of water should be constant.

d. At the end of Mt. Dajti and the beginning of the pressure pipe; sluice gates and a collection chamber which should always be full, to avoid air pockets in the forced-flow conduit and at the turbines. This chamber is also called the "forced-flow conduit intake chamber".

17. The machine house consists of the machine house itself, the anteroom, and a vent. The machine house itself is ovoid in cross-section with the following dimensions: the internal width of the floor is 7.60 meters; 5-meter columns (arc of a circle with a radius of 25 meters); height 4 meters (fully rounded arch with radius of 4 meters) (sic). This is covered with a uniform layer of reinforced concrete 50 centimeters thick. To build this chamber it was necessary to make an excavation in live rock 9 meters wide and 10 meters high. The machine house is dug in the side of a rocky hill, and its major axis is in the direction of the interior of this hill. The covering mass of rock is 5 meters thick at the opening, and increases to a depth of 46 meters at the innermost point. The machine house is reached by means of a so-called safety tunnel.

18. At the western end the machine house forms an anteroom consisting of an excavation 16 meters long, 8 meters wide, and 6 meters high. Between the machine house and the anteroom there is a 3-meter drop, so that the anteroom is 3 meters above the level of the machine house; they are connected by concrete steps, and there is no dividing wall.

19. From the anteroom run two conduits, at an angle of 315°, which carry the high voltage cables.

20. There is a vertical vent at the eastern end of the machine house, which penetrates the rocky mass of the hill above and is 46 meters long. It is concrete-covered and has a square cross-section, each side measuring 1.70 meters. A ladder provides a "safety exit" for personnel in the event of flooding. The longitudinal axis of the machine house is horizontal.

21. The safety tunnel is located to the right side of the machine house, viewing it from the point of entry. The longitudinal axis has a gradient of 1%. The dimensions are: width at the bottom, 4 meters; length, 75 meters; height, 4.70 meters. It has an ovoid cross-section, with 2.40 meter columns and a dome with a radius of 2.30 meters; it is on a level with the machine house, and is covered with a uniform layer of reinforced concrete 0.50 meters thick. The safety tunnel has the function of drawing off water which ordinarily flows to the turbines when repair work is being done, or in the event of any kind of emergency.

22. Between the machine shop and the safety tunnel there is a 7.50-meter stratum of rock, in addition to a meter of concrete (equal to the sum of the thickness of the two internal facings). The machine house can be reached from the safety tunnel by two connecting tunnels, 3.20 meters high and 3 meters wide, respectively, which also serve to carry off water in case of flooding of the machine house. Two other connecting tunnels, smaller than the preceding, permit the passage of the pressure conduits (pipe units carrying water to the turbines) from the safety tunnel to the machine house.

23. The output channel is an ovoid tunnel with the following dimensions: internal height, 2.80 meters; internal width 1.40 meters; thickness of the cement wall, 25 centimeters. The dimensions are the same as those of the first section of the conduit from the "Koleka" tunnel to that of "Jekenit III". The gradient of the longitudinal axis of the output channel is 0.50 meters per thousand.

24. The difference in level between the machine house and the output canal, at the furthest point in, is 5.60 meters. The length of this canal is about 100 meters. At the end of the output canal the water will be conveyed in cast iron pipe units to the projected new aqueduct in Tirana.

Notes on the Plan of the Hydroelectric Plant and its Machinery

25. The pressure pipe, which may consist of one or two pipe units, enters the safety tunnel from the top and goes into the machine house through two opposite connections. In the curved stretch between the top and the left column (viewed from point of entry) of the safety tunnel, there will be both pressure and water flow reducers, safety valves, and vents. The safety valves, when closed, will interrupt the flow of water to the machine house, so that this water, going through the safety tunnel, will pass off outside.

26. There are two more safety valves with the same function which will be located in the two connecting channels, through which the pressure pipe goes to the machine house from the safety tunnel. The safety valves will be of the sluice-gate type.

27. Nothing can be said as to the machinery, as the general plan does not deal with it except in regard to function. However, the machine house will contain two or more Pelton-type turbines, and various electric installations and transformers.

Progress of Work by 1 September 1949

28. The ditch for the siphon from "Jekenit III" to "Great Dajti" has been dug.

29. Work on the digging of the tunnels has been completely finished, except for a total of 750 meters (?00 under Mt. Dajti and 550 in the "Jekenit II" and "Jekenit III" tunnels).

30. Cementing of the vaults of the tunnels of Mt. Dajti has begun, and all preparations have been made to begin this operation in "Jekenit I" tunnel.

31. The plan envisages the completion of the entire work before the end of 1950; but it was deemed possible that it might be delayed beyond that point by lack of cement, pipes, and machinery.

32. The technical director of the work for the whole hydroelectric central of Lanabregasi was reported to be the Albanian engineer Fanteli Staza.

Notes on the Projected Tirana Aqueduct

33. The plan for the Tirana aqueduct envisaged the use of the water flowing out of the Lanabregasi hydroelectric plant. A distributing plant was to be built with a substation in the present reservoir of the Villa Reale. The pipe units of the aqueduct were to be of cast iron.

34. By 1 September 1949 the lines of the conduits of the future aqueduct had already been staked out, from the end of the Lanabregasi output channel to the future distributing installation.

[redacted] Comment: [redacted] a much larger sum was spent in 1949. 50X1-HUM

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